Nesting

The development of the free-range industry has once again placed many hens back into laying eggs in nests rather than in cages. However this caused the re-emergence of some of the problems which were the cause of the development of the cages. These are the increased labour of egg collection, increased time taken to clean the nests, more soiled eggs, and an increase in broody birds.

The production of eggs is the motivation for our enterprise and so anything, which causes a reduction of the number of eggs available for productive use, reduces the viability of the enterprise.

This paper is intended to provide some guidance to those planning to build nesting systems. The material is not intended to be absolutely definitive but to help with an understanding of the remaining wild characteristics of the bird and most effectively harness these biological drives to produce the best effect. This is not a scientific text with cross-references, it is merely a guide.

In past times, nests have been primarily of two types. The first type was a community nest box - all the birds have access to the same area to lay. These nest boxes were designed for 10 to 20 birds and contained litter. The system was ideal for small numbers of birds with a stable pecking order and for many operators these were an ideal structure. However, as the industry developed, numbers increased and the more aggressive strains of bird were selected because they laid more eggs. As a result, the occurrence of cannibalism and egg eating increased. In addition, the number of birds per colony, as well as the overall size of the colony increased. Due to this, population pressures became more prevalent.

In order to try to combat these problems, the individual compartment nest box with an absorbent material (litter) inside, became the standard. This increased the labour, and reduced the operator's access to the eggs, but it also reduced cannibalism by increasing the level of privacy for the birds. Nests in this system needed to be very specific in size for each type of bird. If the nest is a little too large, then two birds would try to use one nest, a little too small and they would discourage use and increase floor eggs. Also, larger numbers of birds placing more pressure on the ranging area around the houses causing the level of dirty feet of the birds to increase, as does the level of dirty eggs increase. To remove some of the dirt from the chicken's feet, slat floors are used. However, these tend to make access to the nests more difficult for egg collection. Wire floors in nests reduce the labour of removing litter, and allow the eggs to roll out easier collection. It was in this way that nesting cages came into the spotlight. Some of the old techniques are being combined with the new to allow the nests to be kept clean, while also giving the birds in the nests free-range access.

FACTORS EFFECTING NEST DESIGN

1. Biological drives
2. Population pressure
3. Light ratio
4. Comfort levels

To properly design nests, we need to understand the biological pressures which drive the bird to a) use the nest and b) select a particular nest site.

The reasons why the bird uses a nest are two-fold.

Reason one is the desire to lay eggs. Egg production is a combination of correct diet, correct age, and the production of light stimulated hormones that trigger the maturation of the egg follicles, and subsequent development of complete eggs. Good management prior to egg production will regulate body weight, lighting, and nutrient consumption, ensuring the maximum egg yield from this hormone production, and subsequently maximum number of nest visits. Consequently, the design of our nests is vital to maximize the desire to lay in nests, minimizing floor eggs.

Reason two is for brooding the eggs to hatch them. This is the result of another hormone that causes the bird to cease laying and to want to sit in the nest and try to hatch the eggs. This is a factor we try to minimize as much as possible. A bird which ceases to lay and becomes established in the brooding process will cease laying for up to 3 months and will usually become uneconomic in the process. In addition this bird will increase the contamination of the nests, and greatly increase the work involved in keeping the eggs clean or cleaning the eggs. The main variation in the tendency to broodiness is genetic, so selection of non-broody strains is important. However temperature in the nest and total time in the nest appear to be additional factors. Increased nest temperature appears to increase the rate of broodiness, so designing good ventilation is advantageous. In addition, if the bird can spend long periods in the nest, either during the onset of broodiness or overnight, and this appears to have a significant effect on the number of birds which proceed on to full broodiness. Interruption of the time in the nest, both at night and during the day seems to reduce the development of full broodiness and the birds continue laying.

There is no conclusive answer as to why the bird chooses the nesting site. The most compelling drives in selection of a nest site is habit and privacy. The bird will select the most secluded, remote location with the best chance of hiding the eggs from predators. This also seems to best explain the cackling after laying an egg. The bird lays the egg, waits until a time when all seems clear, then leaves the nest in a hurry, emitting a warning call as she runs away, hoping that predators will be looking at where she is going, not where she has been.

Another factor to keep in mind is the community influence that seems strong, particularly at the onset of lay. The bird will tend to lay where another has already laid. This seems to be community wisdom: if another hen has laid an egg there then it must be a good place for another. This is of value to us, in that we can use false eggs to establish the habit of correct use of the nest boxes using the community wisdom. However, as a management factor, the poultry man must ensure eggs placed in undesirable locations do not remain there for very long, removing any unwanted behaviour – the laying of floor eggs, for example. An interesting study of nesting systems showed that some systems actually seemed to have the birds lay more eggs than other systems.
This appears illogical, at first. However it seems that some systems ensure all the laid eggs are retained in the nesting systems, and few are laid as floor eggs. These are subsequently eaten or broken and are not even counted. Consequently, total egg

count is an important comparative measure, as well as percentage of floor eggs.

The next factor in selection of nests is comparative light levels or ratios. The darker the nest in comparison with the rest of the house, the better the use of the nest. This can be achieved by a variety of different methods. The important factor here is the ratio between the light and the dark, not the absolute dark. For instance, in small houses we have always placed the nests in the front wall below the main wire open area. This meant that when the fowl is standing in the back of the house and facing forward the iris in the bird's eye will contract and, because the bird is looking at the light, the nest appears dark. The bird tends to use the dark spot. However if the nest is in the rear of the house and the light comes over the bird's shoulders as it looks toward the nest, the nest appears lighter and the birds tend to seek out the darker corners for floor eggs. This effect is also noticed with lighting in sheds. The position of the lighting effects the shadows in the house. If the nest entrances are in shadow, their use increases. If the lights are placed wrongly and shine into the nests, or create shadows elsewhere, the use of the shadows for nesting will increase.

How else can we achieve increased difference (ratio) between light and dark? Make the inside of the nests black – although this is often not practical and can be a detriment to the heat aspect, or paint the inside of the house white. In some houses the use of white slats, either plastic or wood, increases the amount of light floor area compared with the darker interior of the nests. Careful attention to the height and position of artificial lights and windows can also provide useful return benefits.

The last consideration seems to be comfort levels. Included with comfort levels are the following features:

1. Ability to carry out nesting behaviour. As a part of the pre-egg laying, the birds tend to work the nest site by digging and forming it. Wire floors discourage this activity, and therefore we assume would also discourage nest use compared with litter floors elsewhere. In contrast, litter in a nest allows this behaviour but thus increases the cost of cleaning. AstroTurf ® on a wire base provides a springy surface which allows this behaviour, and also has the effect of cleaning the bird's feet. There is also the potential for the floor to be sloped and so allow the eggs to roll out. Moulded plastic nest bases also seem to provide this effect. Mostly, we look for nest material which is cheap, soft, and easy to clean out. We also look for nest boxes to be warm, dry, and draft free. All these features are excellent incentives for use of the nest, however they all have significant detractors, in terms of what we do not want in a nest. Draft free, warm areas are ideal for broodiness, which we want to discourage. Warm litter is an ideal place for parasites to be harboured, and litter costs money to put in and take out. In addition, all the automatic collection litter systems are more expensive.

2. Temperature and ventilation. These are important as a certain warm feel, particularly in winter, encourages nest use; overly warm nests encourage broodiness, and over temperature will stress the birds. However excess ventilation will make the nest uncomfortable.

3. Space has already been mentioned, but it applies in this section as well. Nests too small prevent the above behaviour, increase the temperature problems and

make the nest cramped and thus, less attractive. In colony systems with a large number of hens per nest, overcrowding increases the cannibalism pressure once again.

Please note these are not absolutes, but increase or decrease the pressure for the bird to act a certain way. As poultry managers select the maximum number of "natural" pressures to achieve our aims.

So to summarize, here is a list of the desirable characteristics to have and the features to avoid.

Ideally the nest will have:

- Minimise cost and labour for collection of eggs
- Ensure the eggs remain manure free
- Discourage broodiness
- Minimise parasites
- Minimise cannibalism
- Maximise use by the birds.
- Encourage use, minimising floor eggs and losses
- Use no supplies such as litter and
- Cost a minimum, if anything, to make.

Avoid nests that:

- Are expensive to construct and maintain (must be balanced against labour savings and egg yield)
- Result in dirty eggs
- Encourage broodiness
- Encourage parasites and
- Discourage use.

Here are some design comparisons. This will allow evaluation of potential designs compared with the needs of the particular production situation. I must stress this is a very biased view, based on what I have seen, heard and read about the systems in operation. As I have not seen all the systems in action around the country, and I don't know everything, I am sure I will miss some good systems. Please use this information to promote discussion, thought, and experimentation, rather than as the final word on this topic.

1. Basic nest

This describes a nest box which is literally a box. Fruit boxes, detergent drums cut in half, waxed cardboard boxes, and similar structures are the simplest nests. They usually are on the floor or a very simple stand. They are adequate for small numbers of birds but have severe limitations when considering the design features previously discussed. In general, basic nests will be litter nests requiring regular cleaning, will not be specific sizes for the birds, will lack the privacy, and not have effective light ratios, so will tend to be systems where there are more floor eggs. Whole black detergent drums with one open end tend to overcome some of the light and privacy issues but tend to be too large for single birds and encourage two birds in a nest with egg breakage issues to follow. Broodiness is addressed by the egg collector who should notice by the actions of the birds if broodiness is commencing. Manual removal of the bird from the nest, or the bird from the house can then occur.

2. Basic nest with stands

These help move the nest to a more convenient height for egg collection and so reduce the labour of collection, but increase the price of construction. At the time that nests stands starts to become necessary to reduce the labour costs and difficulties, the availability of large quantities of recyclable material for construction become limiting. Waxed cardboard nests are low cost and can resolve some of these questions, but with an increase of cost, and relatively short life.

Some difficulty occurs is restricting night access to these nests as birds sleeping in the nests, particularly prior to broodiness, increases the level of manure in the nest and in turn, the level of soiled eggs.

3. Colony nests

Colony nests are low cost, as many of the sub-dividers for individual compartments are not needed. If the population is quite stable, and of a non- cannibalistic breeds, these can be quite successful. Also the larger size allows the nest to be made so the light ratio can be addressed. The darkness of the nest sometimes also helps the cannibalism issue. However, a large number of eggs in a group allows a greater incidence of soiled eggs, and the greater probability of egg damage, egg eating and so eggs lost to the system. These colonies need more frequent egg collection. Acceptance of use seems also to be good with dark colony nests, perhaps the community effect also helping. Attention needs to be paid to removal of all birds at night.

4. Basic nests in timber or sheet metal constructed to suit

This is an attempt to standardise a nest to overcome some of the recycled materials, and simple nest limitations. Subject to mite infestations. Nests compartments of specific size related to the breed of bird attempt to ensure the individual bird has its own compartment, and limit cannibalism and squabbling over the nest space. The issue of light ratio can also be addressed, while allowing greater possibilities for limiting height access, by increasing the cost of the materials.

5. Basic nests or colony nests with stands and some slats

These start to address the question of the dirty feet, but if a reasonable amount of slat is used, i.e. more than about 300mm wide, a disadvantage starts to appear in the limitation of the ability to reach to the nests for collection. Slats can be timber, plastic or wire. Timber, spaced correctly, will clean the feed well and if painted white will increase the house/nest light ratio. Timber is however harder to clean, and can harbour red mite. Wire must be carefully selected to ensure foot damage is avoided but is very effective a foot cleaning. Plastic slats have minimal structure, correct colouration, provide excellent cleaning of the feet, and are easy to remove for the end of the batch, but cost more. Slats used in breeder operations need to have about 600 to 900 mm of slats to provide effective feet cleaning. The collection problem can be reduced if the eggs can be collected from the back of the nests, but this may also means that the birds have access to the nests from the back thus negating some of the value of the slat. Building the nests into a wall and allow egg collection from the outside addresses both these issues, but increases the cost and difficulty of cleaning and litter removal. Some difficulty is posed with ensuring the nests are closed off at night with basic nests. Some systems use flip up slats as a lock up on the front to restrict night access.

6. Replacement of litter

Reduction of cleaning costs by removing litter and replacement with alternative floor materials has been tackled by several systems. The most prominent are wire floors, plastic nest bowls, and *AstroTurf* ® floors. Wire has unfortunate implications in cages and is therefore somewhat undesirable, though it does allow low cost rollaway systems. *AstroTurf* ® has a number of advantages, especially the perforated types as they allow sufficient airflow to dry any remaining manure, which has been rubbed off the feet during the nesting behaviour. Plastic nest bowls also appear to be able to perform this task. These systems are addressing many of the difficulties of nest design but at increasing cost per bird housed. The nest can be more enclosed as the need for access for regular litter replacement is removed. If night access is also restricted then the incidence of soiled eggs can be reduced to almost none.

7. Removal of the eggs from the birds

The development of litter alternatives means that rollaway systems which take the eggs away from the birds as soon as they are laid, can be developed. This has the advantages of reducing the possibility of breakage and loss, reducing visual cues to trigger broodiness, reducing the possibility of egg soiling, and increasing the efficiency of collection. All the eggs are in one place and can be collected without

disturbing the birds unduly. Disadvantages are the increased cost of building, and the need to provide some additional visual cues during the onset of lay. False nest eggs help with the onset of lay.

8. Comparison of colony and single bird nest in rollaway structure

Now that rollaway structures are feasible, what are the strengths and weaknesses of the colony, that is one nest compartment 2 or more metres long and .3 metres wide compared with individual compartments say .25 m x .3 m same total numbers per total nest space, assuming similar amounts of slat and similar lighting conditions in the house?

The colony nest will tend to be darker, and this plus the community effect will result in a higher use rate. The single nest will be more open and so more subject to light entry from the house reducing use rate. The colony has less components, so lower manufacturing cost. The colony has fewer parts to clean, and creative construction will mean less time to remove the parts for cleaning compared to single compartment nests. The darkness and enclosed nature of the colony will tend to increase broodiness compared with single nests. However the colony can have simple ejectors compared with single nests.

I do not really think there is an ideal nest system, though some of the commercial mass-produced systems are starting to come close. The following is an evaluation of features found in many commercial systems without naming the systems.

Colony systems with compartment sizes about 2.4m x .3m are now the trend as these have a lower component costs and are easier to dismantle for cleaning. The colony systems are also easier to darken usually having flaps over the access areas without limiting the access. Some of the colony systems feature ventilation chimneys to reduce internal temperatures. Other colony systems use timber instead of steel for the structure.

Virtually all the colony systems use *AstroTurf* ® nest pad material, sitting on a springy wire frame. When the bird engages in nesting behaviour, the spring of the frame ensures any eggs still in the nest roll out to collection, but with a minimum slope on the floor of the nest. Some of the steel systems use 2 tiers high to allow higher density and the rollaway systems allow most systems to be back to back in the centre of the houses rather than along the wall. Egg collection is with a centre belt which carries the eggs to the collection point either with a manual crank or motor drive.

Automatic night time bird ejectors prevent birds from sleeping in the nests, and save the task of manually closing nest doors after first checking all birds are out of the nest. Night soiling is eliminated, and broodiness reduced.

A number of single compartment systems use *AstroTurf* ® or plastic bowl floors, with rollaway for egg collection. In single or double tiers, these systems are still popular for very small flocks, or flocks with cannibalism problems. The higher cost of a lot of small components is the main disadvantage with larger installations.

Slats: All the major manufacturers now recommend slats at the front of the nest with recommendations from .6metres to 2.4 metres wide. This also takes into account drinker and feeder systems.